Paper ID: 38080
oral

SPACE POWER SYMPOSIUM (C3)
Advanced Space Power Technologies and Concepts (3)

Author: Ms. Shenzhan Zhang
Beijing Aerospace Technology Institute, China

Mr. Peng Yu
Beijing Aerospace Technology Institute, China
Mr. Zongqi Xie
Beijing Aerospace Technology Institute, China

THE ACTIVE COOLING DESIGN FOR THE THERMOELECTRIC DEVICES WITH GREAT HEAT FLUX DENSITY

Abstract

For high-speed aircraft,it is a big problem to get energy in high-speed cruise segment.The thermoelectric energy conversion is a worthwhile research orientation through previous validation.Thermoelectric devices are arranged on the surface of the high-speed aircraft. In order to improve the efficiency of power generation, the hot end temperature and the temperature difference of the devices should be improved. The temperature homogeneity of the cold end temperature should also be maintained.At the same time, it is important to ensure that the thermoelectric devices and the aircraft devices are under the safe temperature, which is the key to the design of the high-speed aircraft thermoelectric devices.In this thesis, an active cooling structure of the cold end of the thermoelectric devices has been designed with Si and Ge thermodelectric devices with great heat flux density. The fluid-solid coupling heat transfer simulation has also been completed. Results show that the coolant flow rate and the temperature rise are in accord with the design value.We further carried out the research of the layout of the active cooling pipeline, comparing the influences for the cold end temperature of the thermoelectric devices of the pipeline series, parallel series, and cross line active cooling. Also,we obtained the influences for the cold end temperature of the thermoelectric devices material through changing the material of the active cooling board or covering high thermal conductivity graphite film on the top of the active cooling board.It has been concluded that the cross line active cooling has the best cooling effects when the safe surface structure of the aircraft and enough temperature difference for the thermoelectric devices are ensured.For the sake of convenient processing, the pipeline series active cooling board covered with high thermal conductivity graphite film can also improve temperature homogeneity of the cold end temperature effectively.